

DRAWINGS ATTACHED

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- (21) Application No. 58964/70 (22) Filed 11 Dec. 1970
 (31) Convention Application No. 6 943 002 (32) Filed 11 Dec. 1969 in
 (33) France (FR)
 (44) Complete Specification published 4 Jan. 1973
 (51) International Classification F16K 15/14//B01L 1/00
 (52) Index at acceptance
 F2V J2B
 A4F 24B2A3A2D
 FIN 3B5
 FIX 5



(54) A NON-RETURN VALVE AND A RESERVOIR
 INCORPORATING SUCH A VALVE

(71) We, SOCIÉTÉ ANONYME FRANÇAISE DU FERODO, a French corporate body, of 64 Avenue de la Grande-Armée, 75—Paris, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a non-return valve.

According to the invention there is provided a non-return valve comprising a stepped annular wall having an internal groove and defining a shoulder surrounding an aperture, a flexible diaphragm having a peripheral rim containing a groove to receive the edge of a substantially disc-shaped member such that the diaphragm is applied to one face of said member, the member and the diaphragm containing offset holes relative to each other, and a perforated cover provided with an outer edge engageable with the groove in the stepped wall to hold the rim of the diaphragm in clamping engagement with the shoulder.

Preferably, that face of the member onto which the diaphragm is applied is convex, and the diaphragm is made of resilient material and is stretched over this convex face.

The invention also relates to a reservoir for maintaining a negative pressure, comprising a discharge nozzle capable of being connected to apparatus operated by negative pressure, a stepped annular wall having an internal groove and defining a shoulder surrounding an aperture, a perforated diaphragm of resilient material, provided at its periphery with a rim containing an annular groove in which the edge of a perforated convex disc engages in such a way that the diaphragm is stretched over the convex face of this disc, the perforations in the diaphragm and in the convex disc not being opposite one another, and the said convex

face being directed towards the exterior of the reservoir, and a cover with a nozzle capable of being connected to a source of negative pressure, the edge of the cover being snapped into the groove in the stepped wall so as to clamp the rim of the diaphragm onto the shoulder, a space being maintained between the cover and the perforated portion of the diaphragm.

A reservoir of this kind may be used, in particular, in a motor vehicle with apparatus operated by the pressure produced by the induction of the engine. The apparatus may, for example, be a windscreen wiper, controls for operating valves or flaps in the heating and ventilating system, brake return means, etc. The engine induction is essentially irregular and is practically non-existent during acceleration. The use of a reservoir acting as a negative-pressure accumulator is therefore essential if the supply to such apparatus is to be continuous during acceleration or when the engine is at a standstill.

The following description, referring to the accompanying drawings and given by way of example only, will illustrate an embodiment of the invention. In the accompanying drawings:—

Figure 1 shows a section through a negative-pressure reservoir on a line I—I in Figure 2;

Figure 2 is a plan view of this reservoir; Figure 3 is a bottom view of a curved disc forming part of the closure for this reservoir;

Figure 4 shows a section on a line IV—IV in Figure 3;

Figure 5 is a plan view of a diaphragm intended to co-operate with this curved disc;

Figure 6 represents a partial, enlarged section along a line VI—VI in Figure 5;

Figure 7 is a view similar to Figure 1, showing the reservoir after insertion of its closure; and

Figure 8 is an enlarged view of a part of 90

Figure 7 inside a circle showing the reservoir closure assembly in detail.

The reservoir shown in Figures 1 and 2 is moulded in one piece from a synthetic resin, 5 for example polypropylene. It has a cylindrical outer wall 1 with a bottom 2, whose central portion forms a dish 3 into which a nozzle 4, leading into the reservoir interior, projects axially. The upper portion of the 10 cylindrical wall 1 is open at 1a and joins an annular shoulder generally designated 5, followed by an annular flange 6. The shoulder 5 has a flat portion 5a, situated in a plane perpendicular to the reservoir 15 axis, and a recessed portion 5b which is connected to the portion 5a by a groove 5c and to the inside surface of the flange 6 by a rounded portion 5d. This inside surface of the flange 6 has a cylindrical portion 6a, 20 connected to the rounded portion 5d and containing an annular groove 6b, and a cylindrical portion 6c with a larger diameter, connected to the portion 6a by a truncated cone 6d.

25 The reservoir is intended to be under negative pressure. To enable it to withstand atmospheric pressure, it is provided internally with a cylindrical wall 7, starting from the bottom of the dish around the orifice of the nozzle 4, and a plurality of flat radial 30 walls 8 connected to the bottom 3 and to the cylindrical walls 1 and 7. The walls 7 and 8 end along an edge 9, slightly below the plane of the flat portion 5a of the 35 shoulder.

The curved disc 10 (Figures 3, 4) is moulded in one piece from the same material as the reservoir. It has at its periphery a flat annular surface 11 with substantially the same internal and external 40 diameters as the flat portion 5a on the shoulder of the reservoir, and an edge 12 rounded in the form of part of a torus, projecting towards the outside of the disc but leaving a considerable gap between 45 itself and the surface 6a of the flange 6 when the surface 11 is resting on the shoulder portion 5a of the reservoir. In order to resist atmospheric pressure when the reservoir is 50 under negative pressure, the curved disc 10 is provided on its concave face with a cylindrical wall element 10a and with a plurality of flat radial wall elements 10b connected to the wall 10a and to the concave face of the 55 curved disc. The wall elements 10a and 10b end at an edge 9a, slightly above the plane of the bearing surface 11. The curved disc 10 contains a central hole 13.

The diaphragm 14 (Figures 5 and 6) is 60 made from an elastomeric material such as natural or synthetic rubber. At its periphery it has a rim 15 which is substantially cylindrical when idle, and which projects slightly above the central portion of the diaphragm 65 at 15a and considerably below it at 15b.

This portion 15b is connected internally to the central portion of the diaphragm by an annular groove 16, which has the same toroid shape as the edge 12 of the curved disc 10, but whose cross-section and external 70 diameter are slightly smaller than those of this annular edge 12. When this edge 12 is engaged in the groove 16 (as best shown in Figure 8), therefore, the diaphragm 14 is 75 stretched over the concave face of the curved disc 10, so that it closes the hole 13 in the disc. The diaphragm 14 contains a plurality of holes 17 at an appreciable distance from the centre of the diaphragm, so that 80 when it covers the curved disc as explained above, the holes 17 are offset relative to the hole 13 in the curved disc, that is to say, they are not opposite this hole. When the diaphragm is stretched over the convex face 85 of the curved disc, therefore, it closes the hole 13.

The thickness of the rim 15 is such that the assembly formed by covering the curved disc with the diaphragm 14 enters the inside surface portion 6c of the flange 6 without 90 friction. Pressure is exerted by a curved cover 18 (Figures 7, 8), preferably moulded from the same material as the reservoir and curved disc 10, with substantially the same curvature as the convex face of the latter. 95 The concave face of the cover 18 is reinforced with radial ribs 18a, and the cover has a central nozzle 19 leading into its concave face, between the ribs.

The periphery of the cover 18 has an 100 annular projection 20 on its concave side and an annular outer edge 21, whose shape conforms to that of the groove 6b in the flange 6 of the reservoir and whose diameter is such that the cover 18 engages the surface portion 6c with an easy fit. When a 105 certain pressure is exerted on the cover 18, it is resiliently deformed so that it passes over the conical surface 6d, pushing the rim 15 in front of it, and engages in the groove 6b, crushing this rim. The flat surface 11 of the curved disc 10 comes to bear on the 110 shoulder portion 5a of the reservoir. The purpose of this shoulder portion 5a is to maintain a certain gap 22 between the edges 9 and 9a of the internal fittings 7, 8 and 10a, 10b of the reservoir and curved disc respectively, so that the nozzle 4 and hole 13 communicate freely with the whole of the space inside the reservoir. 120

When the edge 21 of the cover 18 is engaged in the groove 6b, a gap 23 is formed between the ribs 18a on this cover and the diaphragm 14 stretched over the curved disc 10. In this position, illustrated in detail in 125 Figure 8, the rim 15 is compressed radially between the inside surface 6a of the flange and the edge 12 of the curved disc 10. The portion 15b of this rim 15 is also compressed in the recessed portion 5b and the 130

groove 5c of the shoulder 5, and so forms a bead ensuring that the join between the reservoir wall 1 and the curved disc 10 is sealed off perfectly from the atmosphere.

5 The annular projection 20 on the cover 18 bears on the peripheral portion of the diaphragm 14 adjacent to the rim 15, so that this peripheral portion is compressed between the projection 20, the curved disc 10 and the upwardly projecting portion of the edge 12 of this disc. This prevents leakage both at the periphery of the gap 23 and between the diaphragm 14 and curved disc 10 (at the periphery of the latter).

15 The diaphragm 14 normally closes the hole 13. If the nozzle 4 is connected to apparatus which can be operated by negative pressure, and if the nozzle 19 is connected to an intermittently operating vacuum source, for example the induction of the engine in a motor vehicle, operation of this source will produce a negative pressure in the gap 23, and this negative pressure will detach the diaphragm 14 from the curved disc 10, attracting it into the gap 23. The pocket which therefore forms between the disc 10 and the diaphragm 14 communicates with the gap 23 by way of the holes 17 and with the reservoir interior by way of the hole 13. The reservoir is therefore depressurised, and the apparatus connected to the nozzle 4 is made operative. If the vacuum source temporarily ceases to operate, the diaphragm 14 falls back onto the curved disc 10, closing the hole 13. The reservoir interior is therefore kept under negative pressure and will form an accumulator or reserve of negative pressure, enabling the apparatus to remain operative.

40 The device embodying the invention, therefore, can operate both as a non-return valve and as a seal for the reservoir closure. Obviously, the embodiment described is only one example and may be modified, more particularly by substituting technical equivalents, without exceeding the scope of the invention. In particular, if a device embodying the invention is required to close a pressurised reservoir, the diaphragm would be placed on that face of a rigid closure element directed towards the reservoir interior, so that the non-return valve operated in such a direction as to prevent the pressure from escaping from the reservoir.

55 It is also envisaged that the stepped annular wall need not be part of a reservoir but may comprise a separate member, the whole valve device being capable of forming part of a reservoir or of being fitted between two pipe elements.

WHAT WE CLAIM IS:—

1. A non-return valve comprising a stepped annular wall having an internal groove and defining a shoulder surrounding

an aperture, a flexible diaphragm having a peripheral rim containing a groove to receive the edge of a substantially disc-shaped member such that the diaphragm is applied to one face of said member, the member and the diaphragm containing offset holes relative to each other, and a perforated cover provided with an outer edge engageable with the groove in the stepped wall to hold the rim of the diaphragm in clamping engagement with the shoulder.

2. A non-return valve as claimed in claim 1, wherein the substantially disc-shaped member has a convex face, and the diaphragm is made of resilient material and is stretched over this convex face.

3. A non-return valve as claimed in either of claims 1 or 2, in which the cover is placed on the same side as the diaphragm relative to the substantially disc-shaped member, wherein the cover is provided, near its periphery, with a continuous projection capable of clamping onto the said member a portion of the diaphragm adjacent to the rim.

4. A non-return valve as claimed in claim 3, wherein the edge of the substantially disc-shaped member, which engages in the groove in the rim, projects on that face of this member onto which the diaphragm is applied, and the continuous projection on the cover clamps a portion of the rim onto this edge.

5. A reservoir for maintaining a negative pressure, comprising a discharge nozzle capable of being connected to apparatus operated by negative pressure, a stepped annular wall having an internal groove and defining a shoulder surrounding an aperture, a perforated diaphragm of resilient material, provided at its periphery with a rim containing an annular groove in which the edge of a perforated convex disc engages in such a way that the diaphragm is stretched over the convex face of this disc, the perforations in the diaphragm and in the convex disc not being opposite one another, and the said convex face being directed towards the exterior of the reservoir, and a cover with a nozzle capable of being connected to a source of negative pressure, the edge of the cover being snapped into the groove in the stepped wall so as to clamp the rim of the diaphragm onto the shoulder, a space being maintained between the cover and the perforated portion of the diaphragm.

6. A reservoir as claimed in claim 5, in which the annular groove in the stepped wall is formed in a cylindrical portion, adjacent to the shoulder, of the inside surface of this wall, this portion being joined by a truncated cone to a cylindrical entrance portion of larger diameter which the rim of the diaphragm, when engaged over the edge of the curved disc, enters without friction.

7. A non-return valve substantially as herein described with reference to the accompanying drawings.

8. A reservoir including a non-return valve substantially as herein described with reference to the accompanying drawings.

A. A. THORNTON & CO.,

Chartered Patent Agents,
Northumberland House,
303/306 High Holborn,
London, W.C.1.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1972.
Published at the Patent Office, 25 Southampton Buildings, London WC2A 1AY from which copies may be obtained.





